LOUISIANA TECHNOLOGY INNOVATION FUND
Department of Transportation and Development Proposal

Internet-based, Wireless Diagnostics and Predictive Modeling System for Department of Transportation and Development Vehicle and Equipment Assets

August 14, 2003

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I PROJECT TITLE

Internet-based, Wireless Diagnostics and Predictive Modeling System for Department of Transportation and Development (DOTD) Vehicle and Equipment Assets.

II PROJECT LEADER

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III EXECUTIVE SUMMARY

DOTD is requesting **$444,500** from the Louisiana Technology Innovation Fund for the implementation of an Internet-based, wireless diagnostics and predictive modeling system for vehicles and equipment. The proposed system utilizes telematics which combines telecommunications and infomatics, a short form of information technology, to wirelessly flow in-vehicle diagnostics to a centralized fleet management system. If necessary, the fleet system responds to incoming vehicle data by appropriately notifying operators, maintenace and management personnel, and relevant vendors via the Internet and field-based hardware devices. All data is stored in a central data warehouse for interrogation and predictive modeling. If funded the system will be operational in all DOTD locations by **July 2004**.

IV DESCRIPTION OF THE PROJECT

A. Project Narrative

A primary DOTD function is to ensure the operational health of its mission critical vehicle and equipment assets. DOTD passenger vehicles account for nearly 25% of the State's total vehicle fleet. Additionally, DOTD operates in excess of 3,000 high value equipment assets which are used daily for core DOTD activities. DOTD lacks an efficient means of collecting vehicle and equipment information required to ensure adequate maintenance and/or to determine if vehicles and equipment are available for utilization and/or re-utilization.

Inadequate maintenance is the primary cause of premature wear and unscheduled downtime, both of which result in significant DOTD costs. DOTD also lacks a means to calculate vehicle and equipment life cycle costs (for preventive maintenance and unscheduled repairs) or to track utilization. Fast answers to these questions will allow DOTD to make quantitative repair versus replace decisions, as well as deploy underutilized assets more completely.

Currently, DOTD, as well as other LA state agencies, autonomously operates and maintains its vehicle and equipment fleet. DOTD internally operates maintenance and repair facilities and performs much of its own maintainence and repair work for its vehicles and equipment. A few other large state agencies also operate their own maintenance and repair facilities, however most agencies outsource this work to third party vendors. In either scenario, monitoring scheduled service requirements in order to adequately maintain vehicles and equipment is loosely - if at all - administered. DOTD cannot pinpoint cost of ownership or utilization details for its vehicles and equipment. Louisiana Property Assistance Agency (LPAA), the agency responsible for maintaining asset information for all state assets including the State's 12,000+ vehicles, admits it cannot derive cost of ownership or determine utilization statistics for any of the State's vehicles.

DOTD would like to implement new, patent-pending technology for use with its vehicle and equipment assets designed to monitor onboard parameters and diagnostics and wirelessly notify appropriate personnel when maintenance is required or other action is necessary. This technology also continually monitors utilization. Referred to as telematics, this technology interfaces with an Internet-based data warehouse that centralizes information. As such, authorized users can access vehicle and equipment information from any Internet-ready device.

DOTD believes this technology will result in new efficiencies that will drive substantial cost savings such as:

1. Non-productive labor activities such as collecting and updating vehicle and equipment runtime parameters to determine maintenance requirements or other vehicle and equipment problems will be eliminated resulting in reduced man hours. This freed-up labor time will be reallocated to important maintenance work.

2. This technology will enable DOTD to implement knowledge-based asset management. Benchmarking cost of ownership allows for intelligent decision-making (repair vs. replace) and monitoring utilization will result in reutilization efforts to deploy expensive assets more completely, and will prevent or delay unnecessary purchases (see Attachment 1: Countdown to Instant Response).

3. Preventive maintenance activities as a percentage of maintenance and repair work will increase, which will lead to reduced costly downtime and premature wear of expensive assets. Instead of continually repairing equipment items from inadequate maintenance, the focus will shift from the existing loop of "putting out fires" to properly maintaining DOTD assets and preventing unscheduled repairs.

DOTD wants to implement this technology in its headquarters and nine district locations for 50 vehicle and equipment assets at each location. DOTD will use the system to automatically detect required maintenance, monitor vehicle and equipment operating parameters, record maintenance details including associated life cycle costs, and monitor utilization.

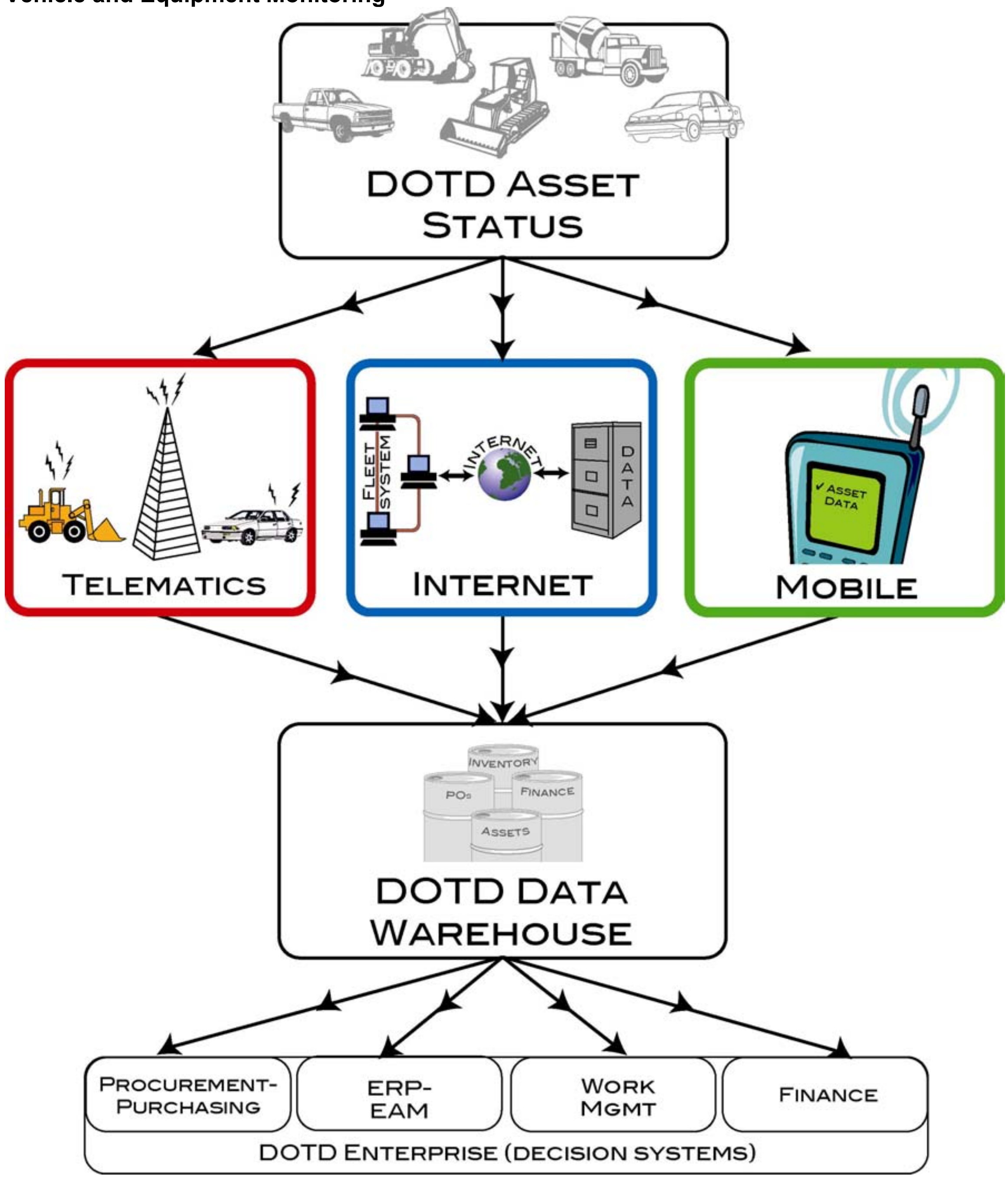
B. Use of Innovative Technology

The proposed technology borrows from proven location tracking and route management solutions common to transportation and field service applications. This type of existing alternate technology utilizes global positioning systems (GPS) and cellular and/or satelite communications to exchange information, such as real-time current location, with a central monitoring system. This technology has proven to generate attractive return for transportation and field service operations. However, upfront and recurring cost for this type of technolgy is significant and includes $1,000+ in per vehicle hardware as well as monthly recurring airtime charges for each vehicle that is equipped with always-on cellular/satellite service in order for the central system to communicate with and monitor vehicle locations real-time.

In contrast, the proposed new, patent-pending technology utilizes much less expensive hardware coupled with WiFi (802.11) radio communications. This WiFi solution incurs approximately one-fourth of the in-vehicle hardware cost compared to the more expensive alternate technology above and has no monthly recurring airtime charges. This hybrid telematics solution monitors and records vehicle operating parameters and diagnostics and transmits the information to a central data warehouse system via strategically located "hot spots". Information is wirelessly collected from each vehicle whenever it comes within range of one of these hot spots, such as a storage facility, service garage, district office, or Interstate/highway location. This form of communication is based on the increasingly popular and low-cost radio frequency dubbed WiFi (see Attachment 2: "WiFi Outlook: Paving the Airwaves for WiFi"). Whenever a WiFi enabled device, such as a vehicle or equipment item, comes within range of a WiFi hotspot, consisting of a base station receiver and antenna, information from the vehicle is offloaded to the base station. The base station then transfers the collected data to a central system, usually via existing Ethernet (wired) network infrastructure. Typical WiFi range is several hundred feet but this range can readily be increased to several miles with amplification and high gain antennas.

Timely and accurate data is crucial for event driven systems, such as fleet management, as well as enterprise information systems used to answer important organizational questions (see Attachment 1: Countdown to Instant Response). The proposed technology eliminates manual data collection procedures such as retrieving mileage or engine hour information needed to determine maintenance requirements and monitor utilization. Additionally, the proposed technology interoperates with various field-based, mobile devices intended to notify relevant personnel when action is required, such as when maintenance is due. This field-based hardware allows mobile workers to access and update the fleet management system from the field while working, thereby eliminating DOTD's current modal workflow process and saving significant labor time. By delivering information to workers at the point of performance the system reduces the amount of time traveling between the field and office and doing paperwork or data entry. Consequently, technicians spend more time maintaining valuable DOTD assets. In addition, eliminating reliance on paperwork also helps prevent human errors associated with data entry. More timely and accurate data capture improves planning, scheduling, decision making, quality control and compliance reporting (see Figure 1 below for image depicting proposed DOTD technology implementation).

<u>Figure 1</u>: DOTD Proposed Technology Implementation (colored boxes) for Remote Vehicle and Equipment Monitoring



C. Multi-agency Application / Portability to Other Agencies

The proposed technology is being requested for use by DOTD but has identical application and benefits for other State fleet operators. Life cycle costing and utilization information are important metrics for any fleet operator. The proposed technology could be made available to all Louisiana state and local government agencies and also serve as a model for other states and private industries to adopt. In fact, the proposed technology has already been demonstrated to the following Louisiana government agencies and each of these agencies has responded with serious interest and/or implementation intent and wants to cooperate with the DOTD project:

1. Louisiana Property Assistance Agency (LPAA)
   Bobby Hill, State Fleet Manager
   1059 Brickyard Lane
   Baton Rouge, LA 70804-9095
   PH: 225-342-6855
   - Responsible for maintaining asset-related information for all 12,000+ Louisiana state passenger vehicles.

2. Louisiana Department of Public Safety (DPS)
   Captain Brad McGlothern, Commander of Support Services
   290 East Airport Road
   Baton Rouge, LA 70806
   PH: 225-925-6154
   - Responsible for maintaining the operational health for approximately 2,000 vehicles used daily for core DPS activities.

3. City of Baton Rouge, Department of Public Works (DPW)
   Terry Blades, Vehicle and Equipment Operations Manager
   333 Chipewa Street
   Baton Rouge, LA 70805
   PH: 225-389-3179
   - Responsible for maintaining the operational health for approximately 2,800 high value equipment items used daily for core DPW activities.

This technology could also be implemented by agencies **without** internal maintenance staff and facilities to alert personnel of required maintenance enabling them to coordinate on-time maintenance. The State could negotiate with commercial vendors to supply statewide maintenance and repair services at a deep discount. Designated State personnel, such as LPAA fleet management staff, could liason with agency fleet operators and review/coordinate their vehicle service with contracted vendors (such as South Carolina does with their “Certified Vendor Repair Program”). This would ensure that vehicle maintenance is performed when necessary, that oversight and confirmation is required for vehicle repairs to prevent unnecessary work/spending, and that service is directed to approved, low cost vendors. Vendors will be eager to contract with the State knowing that all State vehicles will automatically trigger for timely maintenance and that these vehicles will be directed to them for service.

This technology could also be used to monitor vehicle emissions and wirelessly notify appropriate personnel for non-compliance. The proposed technology is designed to plug-and-play with a vehicle’s on-board computer system, assuming that vehicle’s on-board computer is OBD II compliant. All vehicles manufactured since 1996 utilize a standardized computer system to monitor certain vehicle components, including those that regulate vehicle emissions (see Attachment 3: OBD II Emissions Monitoring). OBD II is designed to trigger an emissions-related trouble code whenever the system detects emissions that are 1.5 times the federal allowance. The proposed technology could instantly message this emissions trouble code to the appropriate authority.

This proposal, specifically the proposed vehicle emissions monitoring and notification system, has been discussed with the Department of Environmental Quality (DEQ) and the Baton Rouge Clean Cities Coalition. Both were very interested to cooperate and explore these possibilities, especially in light of Baton Rouge’s current non-attainment status for air quality (see Attachment 4: DEQ News Conference). Mike McDaniel, Executive Director for Baton Rouge Clean Cities Coalition, stated that “ongoing non-attainment status in Baton Rouge will cost in excess of $200 million annually in section

185 penalties and in reformulated gasoline alone". The State has an opportunity with the proposed technology to transform an environmental problem into a revolutionary model that other states and auto manufacturer's can adopt. Following is contact information for the above references:

1. Louisiana Department of Environmental Quality (DEQ)
   Mrs. Teri Lanoue
   P.O. Box 4313
   Baton Rouge, LA 70821
   PH: 225-219-3550
2. Baton Rouge Clean Cities Coalition
   Mr. Mike McDaniel, Executive Director
   7060 Braswell Lane
   Ethel, LA 70730
   PH: 225-683-4425

D. Benchmarking Partners / Best Practice References

1. **Telematics:** See Accenture report (Attachment 5: "Construction equipment industry adopts wireless technology to improve profitability and service") on growing use of telematics technology in fleet/equipment industries for proactive asset management.

2. **Centralized Fleet Management / Contract Fleet Maintenance:** South Carolina has successfully implemented a certified vendor repair program ("CVRP") under the direction of Mr. Bill Page ((803) 737-1506). Additionally, South Carolina maintains a statewide fleet maintenance information system (SCEMIS) allowing them to derive cost of ownership information. Individual South Carolina agencies dial a toll-free phone number to access the State Fleet Maintenance division and have service coordinated for their licensed vehicles at approved vendor repair sites.

E. Long-range Planning

The proposed technology will aide DOTD and the State in its mission to provide accountability and better use and governance of state assets. DOTD has over $562 million invested in its vehicle and equipment fleet alone. The State, through LPAA, cannot currently derive cost of ownership or utilization for the statewide passenger fleet nor can it claim these assets are being properly or cost effectively maintained. This technology will help DOTD and the State achieve its mission of diligent oversight for high value state assets and will lead to substantial, statewide cost savings related to the maintenance and utilization of fleet vehicles and equipment.

Additionally, the proposed technology could help Louisiana pioneer a wireless vehicle emissions monitoring and notification system for positive environmental affect (see Attachment 3: OBD II Emissions Monitoring). Since Baton Rouge currently falls into nonattainment for the EPA's National Ambient Air Quality Standards (NAAQS) for ground-level ozone it makes sense to invest in technologies that could help remedy this situation. Ongoing nonattainment status will cost millions of dollars to taxpayers, industry and governments on all levels.

The opportunity for Louisiana to save money through innovation and set an example in these areas for other states and private industries to follow is compelling reason to invest in this technology (see Attachment 6: Mayor-President Bobby Simpson Recommendation; see also Attachment 7: Congressman Richard Baker Recommendation).

F. Performance Goals

The following performance goals will be monitored and evaluated:

1) **Average *Expected* Maintenance Performed versus Average *Actual* Maintenance Performed** – DOTD will monitor equipment not utilizing the proposed technology versus identical equipment utilizing the technology to determine the number of actual maintenance services (cycles) performed against the number of expected cycles over a particular odometer/meter/date range. DOTD expects that vehicles utilizing the technology will receive timely and adequate maintenance and that equipment not utilizing the technology will receive less timely, inadequate maintenance. These statistics are monitored as standard functionality within the proposed technology (Event Manager Data Warehouse).

2) **Preventative Maintenance Activities as a Percentage of Total Work** – DOTD will monitor the ratio of preventive maintenance (PM) work to emergency repair work orders. It is expected that the proposed technology will increase PM activities as a percentage of maintenance work. Since inadequate scheduled maintenance results in unscheduled failures/downtime, it is expected that increased PM activities will eventually decrease emergency/unscheduled repairs work orders. These statistics are monitored as standard functionality within the proposed technology (Event Manager Data Warehouse).

3) **Monitor Data Gathering and Data Entry Time for Vehicle Parameters** – As in #1 above, DOTD will monitor equipment with and without use of the proposed technology and compare the amount of time and money associated with manually versus electronically gathering and updating equipment operating data (i.e., engine hours, vehicle mileage, maintenance details).

4) **Evaluate DOTD Employees Before and After Technology Implementation –** DOTD will survey employees before and after technology implementation to determine average daily time spent gathering vehicle data, interacting with current versus new fleet system, monitoring and scheduling maintenance requirements in current versus new fleet system, and processing completed service requirements in current versus new fleet system.

5) **Derive Cost of Ownership and Asset Utilization** – DOTD will monitor equipment with use of proposed technology to derive cost of ownership and asset utilization information. Equipment items with the technology will be evaluated as to their level of utilization. These statistics are monitored as standard functionality within the proposed technology (Event Manager Data Warehouse).

G. Technical Approach

1. *Technical description*. The proposed technology involves the Internet, in-vehicle microelectronics (telematics), a centralized fleet management and data warehouse system, and field-based (mobile) computers. Each is described in more detail below:

    a. **Internet**: The proposed technology leverages the Internet as a low-cost networking solution and for its inherent scalability/accessibility. Since the proposed system will be utilized by DOTD statewide across its headquarters and 9 districts, the Internet provides a turnkey, low cost networking medium. Additionally, this configuration requires little to no additional investment as more DOTD sites and users, as well as other State agencies, are brought online.

b. **WiFi Vehicle Microelectronics (Telematics)**: The proposed technology utilizes telematics which combines telecommunications and *infomatics*, a short form of information technology, to wirelessly flow in-vehicle diagnostics to a central system. As previously described, the proposed telematics solution leverages WiFi as opposed to cellular/satellite communication to avoid the recurring wireless service expense associated with cellular/satellite. Also, the proposed technology does not currently include a GPS component. In-vehicle operating parameters such as odometer reading and trouble codes are most relevant for DOTD fleet management needs (location tracking is less important). However, if DOTD later determines GPS information is necessary, the proposed technology supports integration with GPS hardware.

c. **Software**: The proposed technology utilizes an Internet-based data warehouse to centralize information needed for data interrogation and predictive modeling. This data warehouse collects information from the fleet management application, telematics technology, and integrated hardware/software interfaces. The data warehouse can integrate with existing DOTD and State applications (such as third party fleet management systems; LPAA's *Protégé* asset management system, agency ERP/EAM, etc.).

d. **Field-based, Mobile Computers**: The proposed technology interoperates with a variety of field-based hardware such as hand-held, wireless computers and fixed-mount, interactive touch station terminals (NEMA 12 compliant). These devices allow mobile workers to access and update the fleet management system from the field while working.

2. *Interoperability*. The proposed technology leverages open standards and can interoperate when and where appropriate with other open applications (e.g,. LPAA *Protégé* asset management system, agency ERP/EAM systems, etc.).
3. *Technological Alternatives*. As stated in the "Use of Technological Innovation" section above, there exist alternate telematics solutions that focus on real-time location tracking using GPS coupled with cellular/satellite communications. The proposed technology offers similar benefits but at a much lower upfront hardware cost and no recurring airtime charges. If DOTD later decides that real-time GPS (location) tracking is necessary, this feature can be added to the proposed technology.
4. S*calability.* In terms of size, growth is a function of adding hardware and software licenses. Bringing additional vehicles and equipment involves outfitting them with the telematics hardware. Bringing additional system users online requires no hardware/infrastructure modifications since the system leverages the Internet as its networking medium. In terms of capabilities, the system can eventually be utilized to track location and, if desired, for two-way communication with the vehicle/equipment operator.
5. *Maintaining the System*. The proposed technology is offered as a hosted application whereby DOTD accesses the system through the vendor's central server hardware located in the Louisiana Technology Park at the Bon Carré Center. Software updates and maintenance are provided online, real-time by the vendor (offloading this responsibility from DOTD IT staff). The Baton Rouge-based vendor offering the proposed technology will provide contractual service and maintenance support to DOTD.

H. Implementation Approach

DOTD wants to implement the proposed technology for 50 vehicle and equipment items at its Baton Rouge headquarters as well as at each of its nine district locations. DOTD expects the implementation process to take ten (10) months, one month per site. The implementation involves equipping DOTD vehicle and equipment assets with the telematics hardware and implementing the WiFi infrastructure and connected hardware appliances - such as the mobile devices and touch screen terminals - at each district site. All software will be centrally installed and maintained at the vendors data center located in the Louisiana Technology Park at the Bon Carré Center in Baton Rouge, LA.

I. Assessment of Risks

The vendor offering this software and hardware solution has experience with existing customers utilizing identical technology. Additionally, the proposed system is designed to automate basic/core maintenance activities and is relevant for all DOTD vehicle and equipment assets, as well as those of other state agencies.

The problem DOTD needs to solve is collecting and responding to vehicle and equipment operating data in an efficient, timely, accurate and affordable manner. That said, the inherent risk of this project involves potential technical obsolescence with respect to the wireless protocol used to collect the data (i.e., WiFi). However, WiFi has proliferated through business and consumer applications and has become a standard for virtually all wireless local area network (WLAN) applications (see Attachment 2: "WiFi Outlook: Paving the Airwaves for WiFi"). Therefore, the risk of technical obsolescense of the WiFi standard is minimal.

J. Integration with Existing Technologies

Second Generation On-Board Diagnostics (OBD II)
The proposed technology leverages information that is output from a vehicle's on-board computer system. All 1996 or later passenger vehicles and light duty trucks incorporate standard diagnostic systems, referred to as OBD II, used to monitor current or potential vehicle operating problems. The proposed technology will be used to wirelessly monitor these vehicle trouble codes (see Attachment 8: OBD II Trouble Codes) and alert appropriate personnel when necessary. **Important Note:** The genesis for OBD technology was to monitor vehicle emissions (see Attachment 3: ODB II Emissions Monitoring). As such, the proposed technology can be used to monitor DOTD vehicles for emissions compliance. Since one major Louisiana population center, the Baton Rouge metro area, currently falls into nonattainment for the EPA's National Ambient Air Quality Standards (NAAQS) for ground-level ozone, the proposed technology could not only help achieve EPA attainment but also establish a revolutionary standard to ensure environmental compliance for all vehicles and equipment nationwide.

Integration with LPAA's Statewide Asset Management System
The proposed technology will interface with LPAA's Protégé (statewide) asset management system. A primary function of LPAA is to maintain asset information related to the State's 12,000+ licensed vehicles. Currently inaccessible, LPAA's goal is to readily calculate and maintain up-to-date cost of ownership and utilization details for the State's vehicle fleet. DOTD will synchronize its vehicle data with LPAA's Protégé system to enable them to derive this information.

K. Project Budget and Costs

1. EQUIPMENT COST

In-Vehicle Equipment. Two Hundred Thirty (230) vehicle data modules (telematics devices) to be installed on DOTD Central Headquarters vehicle and equipment items and thirty (30) vehicle data modeuls to be installed on at each DOTD location (Baton Rouge HQ and nine district sites) for a total of five hundred VDM's. Each will cost $275 for a total cost of $13,750 per DOTD location, or $137,500 across all DOTD locations.

Workstation Personal Computers. Workstation computers will be used to power ten touch station terminals. Each workstation PC will be configured with a 2.4GHz processor, 120GB hard drive, 256 MB of RAM and NIC. Each will cost $700 for a total cost of $700 per DOTD location, or $7,000 across all DOTD locations.

Workstation Printers. Workstation laser printers will be used at each of ten touch station terminals for hard-copy (redundant) print-outs of equipment maintenance work orders generated by the SmartShop. Each will cost $500 for a total cost of $500 per DOTD location, or $5,000 across all DOTD locations.

Touch Station Terminals and Mounting Hardware. A 15" LCD TFT resistive touch station display (NEMA 12 compliant) with mounting hardware will be installed at each of ten (1) DOTD locations. Each will cost $2,500 for a total cost of $2,500 per DOTD location, or $25,000 across all DOTD locations.

WiFi Access Points and Antennas. WiFi base stations (access points) and high power antennas will be installed at each of ten (10) DOTD locations. Each will cost $1,200 for a total cost of of $1,200 per DOTD location, or $12,000 across all DOTD locations.

WiFi Mobile Hand-Held Computers and Peripherals. WiFi compliant mobile computers w/charging cradles (PalmOS, integrated 1-D bar code element) will be used at each of ten (10) DOTD locations. Each will cost $1,300 for a total cost of $1,300 per DOTD location, or $13,000 across all DOTD locations.

EQUIPMENT COST SUMMARY (PER DOTD LOCATION & TOTAL FOR ALL LOCATIONS)

Location = DOTD Central Headquarters (Baton Rouge)

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	130	$275	$35,750
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$41,950**

Location = Baton Rouge HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	100	$275	$27,500
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$33,700**

Location = New Orleans HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	60	$275	$16,500
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$22,700**

Location = Lafayette HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = Hammond HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = Lake Charles HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = Shrevport HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = Chase HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = Alexandria HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = Monroe HQ

Equipment Type	Quantity	Unit Price	Total Price
In-Vehicle Equipment	30	$275	$8,250
Workstation PCs	1	$700	$700
Workstation Printers	1	$500	$500
Touch Stations and Peripherals	1	$2,500	$2,500
WiFi Access Points and Peripherals	1	$1,200	$1,200
WiFi Mobile Computers and Peripherals	1	$1,300	$1,300
SUBTOTAL COST THIS LOCATION			**$14,450**

Location = ALL, EQUIPMENT TOTAL COST SUMMARY

DOTD Location	Subtotal Per Location
DOTD Central Headquarters	$41,950
Baton Rouge HQ	$33,700
New Orleans HQ	$22,700
Lafayette HQ	$14,450
Hammond HQ	$14,450
Lake Charles HQ	$14,450
Shrevport HQ	$14,450
Chase HQ	$14,450
Alexandria HQ	$14,450
Monroe HQ	$14,450
TOTAL EQUIPMENT COST ALL DOTD LOCATIONS	**$199,500**

2. SOFTWARE COST

SmartShop. One-year subscription and support/maintenance for SmartShop fleet management application to function as the day-to-day interface for maintenance personnel. Cost $120,000 for site license, installation and annual subscription, maintenance and support.

Event Manager Data Warehouse. One-year subscription and support/maintenance for Event Manager Data Warehouse to function as the management tool used to interrogate, model and report on all DOTD vehicle and equipment assets. Cost: $50,000 for site license (up to 15 concurrent users), installation and annual subscription, maintenance and support.

SOFTWARE COST SUMMARY

Software Type	Quantity	Unit Price	Total
SmartShop System	1	$120,000	$120,000
Event Manager Data Warehouse	1	$50,000	$50,000
TOTAL SOFTWARE COST			**$170,000**

3. PROFESSIONAL SERVICE COST

Integration and On-Site Support. Professional service will be required to install the telematics and SmartShop hardware, to integrate the system with existing DOTD network infrastructure/systems and to provide ongoing implementation support of the proposed system. It is estimated that 500 total hours of professional service at a blended consulting/services rate of $150/hour will be required.

SERVICE COST SUMMARY

Service Type	Quantity (Hrs)	Unit Price	Total
Professional Service	500	$150/hour	$75,000
TOTAL SERVICE COST			**$75,000**

V TOTAL FUNDING REQUESTED

In addition to the above and below described costs, please also refer to Attachment 9: DOTD Expenditure Impact, for a detailed analysis.

DOTD has structured this proposal to pilot the proposed technology statewide at its headquarters location and nine district locations. As such, DOTD has considered equipment requirements in order to statistically sample a representitative cross-section of vehicles and equipment at each of these locations (see Section K. 1). If the requested level of TIF funding is not available to pilot the proposed technology across all DOTD locations, DOTD respectfully asks the TIF council to consider funding for central headquarters, Baton Rouge, and New Orleans for a limited pilot (see Section K. 1).

Funding Category	Total Cost	Other Sources	Funding Requested
Equipment	$199,500	$0	$199,500
Software	$170,000	$0	$170,000
Professional Service	$75,000	$0	$75,000
TOTAL FUNDING REQUESTED	**$444,500**	**$0**	**$444,500**

VI COST/BENEFIT ANALYSIS

COST

The total Technology Innovation Funding requested to pilot the proposed technology across DOTD's headquarters and nine district locations is $444,500. Following is a description of expected key benefits from the proposed technology.

BENEFITS

1) Reduced, Reallocated Labor
DOTD maintenance personnel conservatively allocate two man hours annually per machine to collect equipment operating data (e.g., mileage readings; engine hour readings) and transfer this data into DOTD's fleet management system. DOTD currently maintains approximately 3,000 high value equipment assets. Therefore, DOTD personnel allocate about 6,000 man hours annually for collecting and handling operating details for equipment assets alone - not including vehicle assets. Assuming DOTD implements the proposed technology for all equipment assets, this data collection process will be elimated, allowing maintenance personnel to shift more time (up to 6,000 man hours annually) to maintaining DOTD's expensive equipment assets. This translates

into a labor opportunity (savings) of $120,000 annually (using a median burdened payrate of $20.00/hour for DOTD mechanics).

2) Reduced Wear / Reduced Downtime

DOTD realizes that its equipment assets are inadequately maintained in terms of on-time scheduled maintenance. Inadequate preventive maintenance causes premature wear and unscheduled downtime including equipment failure, which results in significant DOTD costs. Premature wear diminishes useful life, accelerates equipment replacement/purchases, and leads to unscheduled downtime. Unscheduled downtime disrupts project workflow resulting in unforeseen costs. The proposed technology will free-up current labor/maintenance resources that will be reallocated to preventive maintenance services and will also ensure that maintenance personnel are notified of preventive maintenance requirements as they become due.

Last fiscal year, DOTD Baton Rouge campus allocated approximately 32,000 man hours for unscheduled vehicle and equipment repairs at a cost of $670,000. Statewide, DOTD allocated over 70,000 man hours for unscheduled repairs at a cost of $1.5 million. Initiating a preventive maintenance regimen via the proposed technology could decrease downtime by as much as 25% (source: Downtime Central). Assuming DOTD reduces unscheduled downtime by a more conservative 10% results in $150,000 annual savings.

3) Extended Useful Life

Properly maintained assets last longer than improperly maintained or neglected assets. As previously mentioned, the proposed technology ensures that maintenance personnel are appropriately notified as equipment maintenance becomes due. The proposed technology also eliminates labor time spent on non-productive activities, such as data collection and update, allowing this time to be reallocated to preventive maintenance work.

DOTD has over $562 million invested in its vehicle and movable equipment assets alone, and attempts to operate these assets for ten (10) years or until zero salvage. With increasing budget constraint for capital expenditures, DOTD must look for ways to maximize asset useful life. As previously suggested, by eliminating data collection labor activities and reducing unscheduled repair labor activities, the proposed technology could free-up more than 13,000 man hours that will be reallocated to preventive maintenance. Assuming this increased attention to maintenance results in just six (6) months added useful life for vehicles and equipment, this translates into millions of dollars in capital expenditure savings.

4) Higher Residual Value

Properly maintained assets retain more value than improperly maintained assets. Experts attest that properly maintained assets retain at least five percent (5%) higher residual value than improperly maintained assets (source: Fleet Owner). With asset capitalization in excess of $500 million, an additional 5% retention in asset value translates into more than $25 million in salvage value.

5) Increased Asset Utilization

With almost 6,000 vehicle and equipment assets, it is impossible for DOTD to monitor utilization and determine under-utilization patterns for all items. More complete asset utilization will result in higher production and prevent unnecessary or premature spending. At an average median cost of $50,000 for each DOTD movable equipment item, avoiding or delaying just five (5) equipment purchases annually results in $250,000 annual capital expenditure savings.

6) Reduced Statewide Repair and Maintenance Costs

As previously described, the proposed technology could enable the State to coordinate on-time maintenance service for its licensed vehicle fleet **and** implement statewide maintenance and repair contracts. Vendors will be eager to provide competitive pricing knowing that the State's entire vehicle fleet will automatically trigger for scheduled service and be directed to them for this work. Reducing the cost of scheduled oil changes alone could result in significant annual savings. As an example, achieving a 30% discount across 8,000 vehicles (8,000 is the approximate number of state vehicles owned by agencies that outsource all service work), assuming a current average oil change cost of $25.00 (where vehicle oil is changed 3X annually), equates to an estimated $180,000 annual savings (8,000 * $25 current oil change cost * 3 times annually * 30% state contract discount = $180,000 annual savings).

VII SIGNED STANDARD FORM

The information included in this proposal represents the best estimates of benefits, costs, and potential for innovative use of technology for the DOTD project “Wireless Diagnostics and Predictive Modeling System for DOTD Vehicle and Equipment Assets”. DOTD will comply with all reporting requirements established by the Louisiana Technology Innovations Council.

Dr. Kam K. Movassaghi, Ph.D., P.E., Secretary	Date
John P. Basilica, Jr., Undersecretary	Date
Mark Suarez, P.E., Maintenance Methods Analysis Engineer	Date

Attachment 1 – Accenture Study (Instant Response)

Accenture Study: Countdown to Instant Response (Accenture Report; May 2003)

The demand for an ever-increasing speed of response has driven the acceptable level of communication from postal mail, to fax, to e-mail to instant message. Emerging technologies will continue to play a role in driving us toward a truly real-time economy.

As part of its research into the future world of instant response, Accenture is exploring what will become possible when the time between stimulus and response approaches zero.

The popularity of instant messaging service shows that we are getting accustomed to instant communication. Accenture has removed one additional barrier to instant communication—language differences—with its
Instant Message Translator. This tool automatically translates text and displays the conversation in the language of both parties. Such technologies will help people to collaborate across time zones and make decisions faster.

But what about the ability for *an object* to initiate communication with a person? Technologies such as sensors and wireless communication can actually help assets act on their own and pre-empt events that may have a negative result. For example, telematics demonstrates how embedded computing, sensors and short-range wireless technologies can be used to monitor and maintain industrial equipment. Critical components—such as in a nuclear plant or even in an airplane—can alert managers of a problem before disaster strikes.

Sensors also can be used to react immediately to theft in the supply chain or in a retail environment. Known as "shrinkage," this constitutes a significant problem for businesses globally. The Accenture Physical Media Tracking prototype, one of many prototypes developed in the Silent Commerce Center, demonstrates how businesses can use radio frequency identification, or other smart tags, to track and find physical objects from dock door to cashier in a retail store. Physical Media Tracking allows intelligent products to assume inventory management and security responsibilities by continuously reporting their exact locations, wherever they may be in the value chain.

Attachment 2 – Business Week Reprint (WiFi Outlook)

"Paving the Airwaves for Wi-Fi" (Business Week reprint; April 2003)
… before the public caught wind of high-speed wireless networks, Vic Hayes was developing standards that allowed the revolution to occur.

Vic Hayes is often regarded as the "father of Wi-Fi." And like the instigators of most tech breakthroughs, he earned his stripes thanks to both luck and good timing. After gaining an electrical-engineering degree in his native Netherlands, Hayes was supposed to start a mandatory 24 months of military service as a Dutch Air Force private. But at his psychological examination, he so impressed his interviewers that at the last moment, they decided he was officer material. This allowed Hayes to get special training in radar and radio technology, subjects that have stuck with him with ever since.

Hayes has made his name not by inventing new technologies but by standardizing them. He started such work in 1974 when he joined NCR Corp., now part of semiconductor components maker Agere Systems. He was asked to help develop industry-wide standards so NCR's terminals for stockbrokers could connect seamlessly via telecommunications lines with similar machines made by other suppliers.

Hayes met that challenge -- along the way creating many of the protocols that govern the Internet today, such as the method by which e-mail travels from sender to recipient. Pleased with his work, his bosses asked him to develop standards for equipment from different suppliers that are used in wireless local area networks (WLANs).

"A PASSION." That was obscure work in the late 1980s and early '90s. Not only did WLANs from different suppliers not communicate, they were expensive. The special committee of the Institute of Electrical and Electronics Engineers (IEEE), which was supposed to develop international standards for the technology, was practically inactive -- until Hayes became its chairman in 1990.

He rounded up experts from other companies -- and within several years the committee's membership ballooned to hundreds. "He has a passion for Wi-Fi, and he got others excited about it as well," says Dennis Eaton, chairman of the Wi-Fi Alliance, an industry association that assures interoperability between Wi-Fi equipment. In 1996, the committee released its first WLAN standard –- 802.11 -- which has since become known as simply Wi-Fi. As part of that process, the group reviewed different corporations' technologies and fine-tuned them to arrive at the standard.

Wi-Fi has since come into its own, pushing down the price of everything from Web access to WLAN gear and starting a communications revolution. "The standards, which wouldn't have been produced without Hayes, established credibility for Wi-Fi," says Craig Mathias, founder of wireless consultancy Farpoint Group in Ashland, Mass.

LOTS OF "HOT SPOTS." Today, Wi-Fi, which stands for wireless fidelity, allows anyone with a laptop and a wireless card to connect to the Web at high speeds in thousands of hotels, airports, and Starbucks cafés nationwide. Individuals have created tens of thousands of other Wi-Fi "hot spots" around the country -- and anyone with the right wireless card who's within several hundred feet of them can piggyback for free. WLAN equipment suppliers will generate $1.67 billion in revenue in 2003, up from about $1.25 billion last year, according to Allied Business Intelligence, a technology research think tank in Oyster Bay, N.Y.

This is just the beginning. "…Wi-Fi will be used for everything" eventually, says Hayes. Within 5 to 10 years, he predicts, Wi-Fi connection speeds should increase from the current average of 54 megabits per second to hundreds of megabits, thus enabling nifty applications such as real-time video streaming in homes, he says. Users would be able to download movies from satellite or cable feeds, store them on a shared hard drive, and stream them onto TV screens around the house.

Wi-Fi networks could also eventually be used to make phone calls, Hayes believes. Some tech outfits already are working on early versions of such systems. Calls sent via a Wi-Fi network would be cheap because they would be routed through the Internet instead of over the phone companies' dedicated lines.

TECH DIPLOMAT. Much remains to be done before that can happen, and Hayes, at 61, isn't letting up on his work. Now a senior scientist at Agere, he stopped presiding over the IEEE committee in 2000, after serving as long as the group's charter allows. He now heads the regulatory subcommittee at the Wi-Fi Alliance, which works with governments worldwide to make sure they allocate the same spectrum for Wi-Fi communications. Today, the U.S., Europe, and Japan allocate different amounts of spectrum for these networks. As a result, people who use Wi-Fi in the U.S. might have to reconfigure their Wi-Fi card or purchase a new one to be able to use Wi-Fi in Europe.

Hayes hopes to iron out these wrinkles within a year -- and chances are he'll succeed. Last year, the Chinese government was considering limiting the power output of Wi-Fi networks to one-tenth of maximum. That would have increased interference and limited the networks' coverage, forcing corporations in China to deploy many more access points. Hayes flew to Beijing, where he says he persuaded government officials to back off. "My work is more political and diplomatic now," he notes.

Indeed, "I'm too busy to experiment with Wi-Fi," Hayes laughs. At home, he has a server connected to a Wi-Fi network. But mostly, he uses it to get on Agere's extranet and keep up with his work rather than for testing out new Wi-Fi applications. He leaves that to the rest of the world.

Attachment 3 – OBD II Emissions Monitoring

Onboard diagnostics, or the ability to self-detect faults, has been an integral feature of all computerized engine control systems since the early 1980s. OBD II (2nd generation, current ODB) evolved as a means of detecting problems that increase emissions. Specifically, OBD II reports any problem that increases emissions 1.5 times the allowable federal standard as established by the Federal Test Procedure that a new vehicles must comply with when they are initially certified for emissions compliance.

The first generation of OBD was spawned in California by the California Air Resources Board (CARB) in 1988. The original OBD rules (which applied only to vehicles sold in California) required a warning lamp to illuminate if a problem occurred with monitored components in the emission control system.

There is current [DEQ] talk of making OBD II a part of enhanced emissions testing. A vehicle would be interrogated electronically to see if there are any OBD II fault codes in memory and that all self-tests have been performed and passed. If the vehicle doesn't pass the OBD test, it would fail even though it might actually pass a tailpipe emissions test. This proposed rule would only apply to 1996 and later vehicles.

Unlike all previous self-diagnostic systems that the vehicle manufacturers have devised to detect failures in sensors and circuits, OBD II is almost like having a self-contained emissions analyzer under the hood. Though OBD II does not measure hydrocarbon (HC), carbon monoxide (CO) or oxides of nitrogen (NOX) emissions, it can detect conditions that may cause the levels of these pollutants to rise. So think of OBD II as the long arm of the Environmental Protection Agency in the engine compartment ready to wave a red flag whenever an emissions-related problem occurs that causes emissions to raise 1.5 times the federal limit.

The heart of the OBD II diagnostics are the special "monitors" or self-tests it performs to keep tabs on how systems are functioning. The monitors include:

Oxygen sensor monitor - Two tests are done to check the operation of the "upstream" 02 sensor(s) mounted ahead of the catalytic converter. When the 02 sensor reaches operating temperature, the fuel mixture is made rich momentarily. The power-train control module (PCM) then looks for a corresponding rich signal (.745 volts or higher) to determine if the 02 sensor is working properly. This test isn't run until the engine is warm (coolant temp of at least 170 degrees F), and approximately three minutes have passed since engine start-up (or the vehicle has been driven faster than 24 mph for two minutes, is warm, the transmission is in drive, and the engine is idling with the high pressure power steering switch off). The second 02 sensor test monitors the sensor's response time. The PCM changes the frequency of the air/fuel ratio to see if the oxygen sensor keeps pace. The PCM may also look at how long it takes the sensor to heat up (to check the condition of the heater element), and look for over-voltages. The 02 monitor tests won't run if the Malfunction Indicator Lamp (MIL) is on due to engine misfire, an 02 sensor fault, vehicle speed sensor fault, park/neutral safety switch fault, or if the engine is in a limp-in mode due to a failed MAP sensor, Throttle position sensor or coolant sensor.

Heated 02 monitor (downstream 02 sensor) - This test checks the oxygen sensor located aft of the catalytic converter. It starts 5 seconds after the engine has been shut off. The PCM applies a short (35 millisecond) voltage signal to the sensor's output wire every 1.5 seconds to prepare the sensor for a voltage drop test. The sensor passes the test if it shows a .150 voltage drop for half of the 30 pulses given to it during the test. This test will only run if the engine has been run at least 5.1 minutes and there are no upstream or downstream 02 fault codes present.

Catalytic converter efficiency monitor - OBD II uses a second heated 02 sensor downstream of the converter to keep tabs on converter operating efficiency. The PCM compares the switching rates of the upstream and downstream 02 sensors to tell how well the converter is working. The upstream 02 sensor should have a much higher switching rate than the downstream 02 sensor when all is well. But if the switch rate of the downstream sensor comes to within 70% to 90% of the upstream 02 sensor, it tells the PCM that the converter is bad and needs to be replaced.

• Evaporative emissions control monitor - A pressure or vacuum test of the fuel system is performed by an internal monitor to detect air leaks that could allow fuel vapors to escape into the atmosphere. This test is done once each trip.

• EGR monitor - Checks up on the EGR system. The PCM shuts off the EGR solenoid momentarily once the engine is warm and running, then watches the signal response from the 02 sensor. If the 02 sensor gives a lean indication, it verifies the operation of the EGR valve. This test is done once per trip, but won't run if the MIL is on due to misfire, a fuel trim problem, 02 sensor fault, EGR solenoid fault, cam or crank sensor fault, or the engine is in a limp-in mode.

• Fuel system monitor - Like "block learn," it tracks the ongoing fuel balance to see if the fuel mixture is running rich or lean. The fuel system is monitored continuously as soon as the engine goes into closed loop. But this test will not run if the MIL light is on due to misfire, upstream 02 sensor fault, EGR fault, canister purge fault, cam or crank position sensor fault, or the engine is in a limp-in mode. The test will illuminate the MIL lamp if long term and short term fuel trim become too far apart.

• Secondary air monitor - Checks the output of the air pump by keeping tabs on where the air is going (to the manifold or the converter). Done once per trip.

• Engine misfire monitor - By detecting subtle changes in engine speed via a crank and/or cam position sensor, the number of misfires per engine rpm can be tracked to reveal any patterns that might cause emissions to rise. Misfires are monitored continuously and "graded" according to increments of speed (1,000 rpm or 200 rpm). The monitor notes how many misfires occur every 200 rpm. A rate of misfire exceeding 2% in 1,000 RPM increments, or 15% in 200 rpm increments sets a temporary code that becomes a hard code if the problem continues. In cases of severe misfiring, the catalytic converter may be damaged by unburned fuel so the MIL comes on and flashes continuously to alert the driver. If the misfiring goes away, the MIL light will stop flashing but will remain on until the problem is repaired or the code is cleared.

• Comprehensive Component monitor - This test covers an extensive list of components and essentially looks at all major inputs going into the PCM and its outputs. The list of components varies according to the vehicle application but includes such things as all engine sensors, transmission status sensors, shift and torque converter solenoid outputs, idle air control outputs, canister purge and purge vent solenoid outputs. This monitor looks for shorts, opens, and values that are out of range or do not agree with engine operation.

Attachment 4 – DEQ News Conference

State of Louisiana
Department of Environmental Quality

M.J. "Mike" Foster
Governor

L. Hall Bohlinger
Secretary

L. Hall Bohlinger
Secretary
Louisiana Department of Environmental Quality
Statement
News Conference
Thursday, May 22, 2003
Baton Rouge, Louisiana

Good morning and welcome to the Louisiana Department of Environmental Quality. I am Hall Bohlinger, Secretary of DEQ.

The U.S. Environmental Protection Agency recently changed the classification of the Greater Baton Rouge area from serious to severe. This is because we did not manage to reduce ozone levels to meet federal standards by the established deadline set by the Clean Air Act. My fellow speakers and I are here together because we all recognize how important it is for the Greater Baton Rouge area to work in unison to reduce activities that lead to the formation of ozone.

Scientific data shows that for the past thirty years, air quality in our state has steadily improved. EPA has set six of what it calls criteria air pollutants, to measure air quality. With the exception of the Greater Baton Rouge area, the rest of the state is in attainment for all six. The Greater Baton Rouge area is in attainment for five of them. The pollutant we are still grappling with in the area is ozone. But even ozone levels have been on the decrease. In the year 2000, our area exceeded ozone levels 11 days. By 2001, the number of days was reduced to one and only two were recorded in 2002. So as you can see, our area was reclassified not because our air quality has worsened, but because we failed to meet the deadline set by the Clean Air Act. Over to my right, you can see a map of where we were with the ozone standard in 1978 and where we are today. Our area, which is highlighted in the map, is known as the five-parish non-attainment area when it comes to ozone related matters.

The EPA reclassification will bring with it the implementation of new measures, some of which will require that we adjust our purse strings as well as our lifestyles. The measures will have an impact on every area resident at a personal level. However, our fate is not yet sealed. We still have an opportunity to prevent some of these onerous new requirements from taking hold in our area…If we work together. And work together we will.

DEQ in its role as the environmental state agency and also in its capacity as part of the Baton Rouge Clean Air Coalition is doubling the efforts of the Coalition to raise public awareness and elevate the level of cooperation in the battle against ozone. To this end, the Capital Region Clean Air Campaign has been created. The campaign is titled, "We Can (Clean the Air Now)," the slogan of the campaign is "Do Your Share For Cleaner Air." Its objective is to stress how crucial it is for each one of us to be mindful of how our daily activities impact air quality in the area and what great benefits await all of us if we all do our share for cleaner air this summer season. The campaign is looking to promote the right mix of collaborative and individual efforts to bring the area into attainment.

A number of public outreach activities are taking place at all levels. Governor Foster has already alerted state agencies to participate in the Baton Rouge area's Ozone Action Program. All the parish presidents have been very active in speaking to key groups to explain the root of the problem and request cooperation. The members of the DEQ Ozone Awareness Outreach Team, who you see here in T-Shirts, will be going out and are available to participate in public forums to provide the public with information about what each one of us can do to help avoid a classification that, in practice, we do not deserve. You can see some of those tips in the poster over to my left. We would like to see these tips applied as part of a daily routine and not just on days when ozone action alerts are issued. We want to drive the message home that by incorporating these tips into our daily lives, we will be helping to clean our air now and in the future. One of the most important tips in the list is number 10. "SPREAD THE WORD."

As I have already said, the campaign is looking to promote the right mix of collaborative and individual efforts to bring the area into attainment and the effort should not rely solely on individual actions. For this reason, I have also sent a letter to area industry asking them to be mindful of our attainment situation and to conduct a review of their operations to see what opportunities might be available to curtail or reduce activities that produce ozone-forming pollutants.

We want to use every tool available to garner everyone's cooperation in bringing the area into attainment to avoid a reclassification. But we should not lose sight of the fact that attainment of this standard also brings important benefits such as cleaner air and an improved regulatory environment for economic development.

As I told my fellow speakers when I asked them to join me here today, we have an opportunity this season to write the Greater Baton Rouge area success story. I think that if we obtain everyone's cooperation we stand a pretty good chance.

Now I want to turn the microphone over to Mike McDaniel, Executive Director of the Baton Rouge Clean Air Coalition.

Attachment 5 – Accenture Study (Equipment Telematics)

Accenture Study: “Construction equipment industry adopts wireless technology to improve profitability and service” (Accenture Report; March 2003)

More than three out of four construction equipment manufacturers in North America now offer telematics products and services to their customers, according to an Accenture study of executives in the construction industry. In addition, 80 percent believe that equipment telematics offers an advantage over competitors and they anticipate extra benefits from the wireless technology that include enhanced customer relationships and increased parts and services revenue.

Equipment telematics -- wireless-enabled communication between vehicles or equipment and their external environment for the automatic collection and dissemination of data -- addresses some of the most critical operational and business challenges facing construction and rental equipment companies, including increasing equipment utilization, managing maintenance costs and increasing operational efficiency.

Mobile applications of equipment telematics in the construction equipment industry include, among other things, vehicle tracking, positioning and online navigation; data collection regarding vehicle usage and maintenance; and emergency services.

"Historically, the construction equipment industry has taken a conservative approach to using new technologies, but we're now witnessing a transformation of these companies from product manufacturers to service providers," said Dean Teglia, the North American managing partner for Accenture's Industrial Equipment practice. "And equipment telematics will be the key enabling technology that changes their business model and allows them to focus on service and growing revenues."

Study Findings

Nearly two-thirds (62 percent) of respondents said they foresee improved profitability from providing equipment telematics services, while 60 percent said they believe that equipment telematics will enable them to increase revenue from parts and services.

More than two-thirds (70 percent) of respondents said that equipment telematics solutions could help them enhance customer relationships through increased knowledge of vehicles' usage patterns and maintenance servicing.

Construction equipment users said they expect that 20 to 30 percent of new equipment will incorporate telematics in the next three years, and dealers predict a 15 to 20 percent penetration of telematics in new equipment over the same period.

Nearly half (45 percent) of survey respondents said they consider predictive maintenance to be the area of greatest interest for adopting equipment telematics, and more than one-third (35 percent) said they consider the integration of telematics services with fleet management systems to be the most critical success factor.

Research Methodology

Accenture commissioned a study of the construction equipment segment to determine the extent to which potential providers (original equipment manufacturers and dealers) and users (construction and rental companies) have adopted and delivered equipment telematics products and services. The telephone survey sought the opinions of 54 executives across four industry segments: construction original equipment manufacturers (six respondents), construction companies (17 respondents), construction original equipment dealers (28 respondents) and construction original equipment rental concerns (three respondents). Respondents were screened to ensure that they had some familiarity with telematics and involvement with technology decisions.

Attachment 6 – Mayor-President Bobby Simpson Recommendation

Office of the Mayor-President
City of Baton Rouge
Parish of East Baton Rouge

222 St. Louis Street
Post Office Box 1471
Baton Rouge, Louisiana 70821

225/389-3100
Fax 225/389-5203

BOBBY SIMPSON
Mayor-President

August 12, 2003

Mr. Chad McGee, Chief Information Officer
Division of Administration
Office of Information Technology
1201 North Third Street, Suite 2-130
Baton Rouge, Louisiana 70804-9095

RE: Recommendation for DOTD/TurfCentric TIF Project

Dear Mr. McGee:

I am writing to offer my support for a request for $444,500 from the Louisiana Department of Transportation & Development to implement the TurfCentric system using Technology Innovation Funding.

The Department of Transportation recently demonstrated a remote vehicle/equipment monitoring system to the Baton Rouge Department of Public Works (DPW). This system is designed to alert maintenance personnel of scheduled maintenance and potential vehicle/equipment malfunctions. Terry Blades, DPW's Vehicle/Equipment Operations Maintenance Manager, subsequently contacted my office to encourage the City's further evaluation. Consequently, Don Evans, Director of Information Services for the City of Baton Rouge, determined the system has application for all city-operated vehicles/equipment, including DPW, Baton Rouge Police, Emergency Medical Services, and several others. We have also learned that the system can be used to remotely monitor vehicle emissions through a vehicle's on-board diagnostic (OBD II) system. I am sure you are aware of this significance and the importance to monitor and lower emissions, given Baton Rouge's non-attainment status for air quality.

DOTD has partnered with TurfCentric, a Baton Rouge-based company which is located in the Louisiana Technology Park at Bon Carré Business Center, to pilot this patent-pending technology. As you may know, I am active on Research Park Corporation's Board of Directors - RPC is the Tech Park's parent company - and encourage support for its member companies.

A COMMUNITY WITH CHARACTER...A COMMUNITY THAT CARES

I understand DOTD is seeking to implement the TurfCentric system via Technology Innovation Funding (TIF) administered by the Division of Administration. Irregardless of my affiliation with RPC, I believe this technology is a textbook example for private-public partnership projects this fund is intended to foster. Therefore, it is my strong opinion that the DOTD/TurfCentric TIF project should be seriously considered for funding.

Please feel free to call my office at (225) 389-5100 if you have any questions, or would like to further discuss this matter.

Sincerely,

Bobby Simpson
Mayor-President

cc: Mr. Dominic Cali, IT Director, Department of Transportation and Development
Mr. Mark Drennen, Division of Administration
Mr. Jerry Guillot, Louisiana State Senate
Mr. Robert Harper, Department of Natural Resources
Mr. Don Hutchinson, Louisiana Economic Development
Mr. Butch Speer, Louisiana House of Representatives

Attachment 7 – Congressman Richard Baker Recommendation

RICHARD HUGH BAKER
6TH DISTRICT, LOUISIANA

COMMITTEE ON
FINANCIAL SERVICES

CHAIRMAN
SUBCOMMITTEE ON
CAPITAL MARKETS, INSURANCE AND
GOVERNMENT SPONSORED ENTERPRISES

SUBCOMMITTEE ON
FINANCIAL INSTITUTIONS
AND CONSUMER CREDIT

SUBCOMMITTEE ON
HOUSING AND
COMMUNITY OPPORTUNITY

Congress of the United States
House of Representatives
Washington, D.C. 20515–1806

COMMITTEE ON
TRANSPORTATION AND INFRASTURCTURE

SUBCOMMITTEE ON HIGHWAYS
TRANSIT AND PIPELINES

SUBCOMMITTEE ON AVIATION

SUBCOMMITTEE ON
WATER RESOURCES AND ENVIRONMENT

COMMITTEE ON
VETERANS' AFFAIRS

SUBCOMMITTEE ON HEALTH

August 7, 2003

Mr. Chad McGee, Chief Information Officer
Division of Administration
Office of Information Technology
1201 N. Third Street, Suite 2-130
Baton Rouge, LA 70804-9095

RE: Recommendation for DOTD/TurfCentric TIF Project

Dear Mr. McGee:

Through my association with the First Tee Program at the Youth Challenge Center in Carville, I have become familiar with TurfCentric, a Baton Rouge-based company located in the Louisiana Technology Park at Bon Carré. In my dealings with TurfCentric—a job training partner with my office at Carville—I have learned about their products and business model. Without question, this company has immediate potential to positively impact our local economy and is on the verge of explosive growth.

Historically, TurfCentric has provided specialized software to assist golf courses with managing their maintenance operations. Over the last year, the company has developed a rugged WiFi device for use on equipment and vehicles. Being developed for two-way communication, this patent-pending device monitors utilization and transmits diagnostic information to maintenance personnel when service is required. Going forward, TurfCentric intends to broaden its market focus on all fleet operators including, but not limited to, those in the agriculture, construction, and government sectors.

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WWW.BAKER.HOUSE.GOV

The Louisiana Department of Transportation & Development is submitting a request for $444,500 to implement the TurfCentric system using Technology Innovation Funding. DOTD has already demonstrated this system to other state fleet operators including LPAA, DPS, and DPW. All have expressed serious interest and/or implementation intent and want to cooperate with the DOTD/TurfCentric project. Having witnessed this technology first-hand, I believe its cost saving potential merits additional evaluation. As such, I would like to request that this project be given thorough consideration. As always, take whatever action that you feel results in the benefit to the taxpayers. Should you have any questions regarding this request, please contact my Chief of Staff, Mrs. Christina Casteel, at (225) 929-7711.

Sincerely,

Richard H. Baker
Member of Congress
Sixth District of Louisiana

cc: Mr. Dominic Cali, IT Director, Department of Transportation and Development
Mr. Mark Drennen, Division of Administration
Mr. Jerry Guillot, Louisiana State Senate
Mr. Robert Harper, Department of Natural Resources
Mr. Don Hutchinson, Louisiana Economic Development
Mr. Butch Speer, Louisiana House of Representatives

Attachment 8 – OBD II Trouble Codes

P0100 Mass or Volume Air Flow Circuit Malfunction
P0101 Mass or Volume Air Flow Circuit Range/Performance Problem
P0102 Mass or Volume Air Flow Circuit Low Input
P0103 Mass or Volume Air Flow Circuit High Input
P0104 Mass or Volume Air Flow Circuit Intermittent
P0105 Manifold Absolute Pressure/Barometric Pressure Circuit Malfunction
P0106 Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance Problem
P0107 Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108 Manifold Absolute Pressure/Barometric Pressure Circuit High Input
P0109 Manifold Absolute Pressure/Barometric Pressure Circuit Intermittent
P0109 Intake Air Temperature Circuit Malfunction
P0111 Intake Air Temperature Circuit Range/Performance Problem
P0112 Intake Air Temperature Circuit Low Input
P0113 Intake Air Temperature Circuit High Input
P0114 Intake Air Temperature Circuit Intermittent
P0115 Engine Coolant Temperature Circuit Malfunction
P0116 Engine Coolant Temperature Circuit Range/Performance Problem
P0117 Engine Coolant Temperature Circuit Low Input
P0118 Engine Coolant Temperature Circuit High Input
P0119 Engine Coolant Temperature Circuit Intermittent
P0120 Throttle/Petal Position Sensor/Switch A Circuit Malfunction
P0121 Throttle/Petal Position Sensor/Switch A Circuit Range/Performance Problem
P0122 Throttle/Petal Position Sensor/Switch A Circuit Low Input
P0123 Throttle/Petal Position Sensor/Switch A Circuit High Input
P0124 Throttle/Petal Position Sensor/Switch A Circuit Intermittent
P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control
P0126 Insufficient Coolant Temperature for Stable Operation
P0130 O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)
P0131 O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)
P0132 O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)
P0133 O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)
P0134 O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)
P0135 O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)
P0136 O2 Sensor Circuit Malfunction (Bank 1 Sensor 2)
P0137 O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)
P0138 O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)
P0139 O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)
P0140 O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)
P0141 O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)
P0142 O2 Sensor Circuit Malfunction (Bank 1 Sensor 3)
P0143 O2 Sensor Circuit Low Voltage (Bank 1 Sensor 3)
P0144 O2 Sensor Circuit High Voltage (Bank 1 Sensor 3)
P0145 O2 Sensor Circuit Slow Response (Bank 1 Sensor 3)
P0146 O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 3)
P0147 O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 3)
P0150 O2 Sensor Circuit Malfunction (Bank 2 Sensor 1)
P0151 O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)
P0152 O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)
P0153 O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)
P0154 O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)
P0155 O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)
P0156 O2 Sensor Circuit Malfunction (Bank 2 Sensor 2)
P0157 O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)
P0158 O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)
P0159 O2 Sensor Circuit Slow Response (Bank 2 Sensor 2)
P0160 O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)
P0161 O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)
P0162 O2 Sensor Circuit Malfunction (Bank 2 Sensor 3)
P0163 O2 Sensor Circuit Low Voltage (Bank 2 Sensor 3)
P0164 O2 Sensor Circuit High Voltage (Bank 2 Sensor 3)
P0165 O2 Sensor Circuit Slow Response (Bank 2 Sensor 3)
P0166 O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 3)
P0167 O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 3)
P0170 Fuel Trim Malfunction (Bank 1)
P0171 System too Lean (Bank 1)
P0172 System too Rich (Bank 1)
P0173 Fuel Trim Malfunction (Bank 2)
P0174 System too Lean (Bank 2)

P0175 System too Rich (Bank 2)
P0176 Fuel Composition Sensor Circuit Malfunction
P0177 Fuel Composition Sensor Circuit Range/Performance
P0178 Fuel Composition Sensor Circuit Low Input
P0179 Fuel Composition Sensor Circuit High Input
P0180 Fuel Temperature Sensor A Circuit Malfunction
P0181 Fuel Temperature Sensor A Circuit Range/Performance
P0182 Fuel Temperature Sensor A Circuit Low Input
P0183 Fuel Temperature Sensor A Circuit High Input
P0184 Fuel Temperature Sensor A Circuit Intermittent
P0185 Fuel Temperature Sensor B Circuit Malfunction
P0186 Fuel Temperature Sensor B Circuit Range/Performance
P0187 Fuel Temperature Sensor B Circuit Low Input
P0188 Fuel Temperature Sensor B Circuit High Input
P0189 Fuel Temperature Sensor B Circuit Intermittent
P0190 Fuel Rail Pressure Sensor Circuit Malfunction
P0191 Fuel Rail Pressure Sensor Circuit Range/Performance
P0192 Fuel Rail Pressure Sensor Circuit Low Input
P0193 Fuel Rail Pressure Sensor Circuit High Input
P0194 Fuel Rail Pressure Sensor Circuit Intermittent
P0195 Engine Oil Temperature Sensor Malfunction
P0196 Engine Oil Temperature Sensor Range/Performance
P0197 Engine Oil Temperature Sensor Low
P0198 Engine Oil Temperature Sensor High
P0199 Engine Oil Temperature Sensor Intermittent
P0200 Injector Circuit Malfunction
P0201 Injector Circuit Malfunction - Cylinder 1
P0202 Injector Circuit Malfunction - Cylinder 2
P0203 Injector Circuit Malfunction - Cylinder 3
P0204 Injector Circuit Malfunction - Cylinder 4
P0205 Injector Circuit Malfunction - Cylinder 5
P0206 Injector Circuit Malfunction - Cylinder 6
P0207 Injector Circuit Malfunction - Cylinder 7
P0208 Injector Circuit Malfunction - Cylinder 8
P0209 Injector Circuit Malfunction - Cylinder 9
P0210 Injector Circuit Malfunction - Cylinder 10
P0211 Injector Circuit Malfunction - Cylinder 11
P0212 Injector Circuit Malfunction - Cylinder 12
P0213 Cold Start Injector 1 Malfunction
P0214 Cold Start Injector 2 Malfunction
P0215 Engine Shutoff Solenoid Malfunction
P0216 Injection Timing Control Circuit Malfunction
P0217 Engine Overtemp Condition
P0218 Transmission Over Temperature Condition
P0219 Engine Overspeed Condition
P0220 Throttle/Petal Position Sensor/Switch B Circuit Malfunction
P0221 Throttle/Petal Position Sensor/Switch B Circuit Range/Performance Problem
P0222 Throttle/Petal Position Sensor/Switch B Circuit Low Input
P0223 Throttle/Petal Position Sensor/Switch B Circuit High Input
P0224 Throttle/Petal Position Sensor/Switch B Circuit Intermittent
P0225 Throttle/Petal Position Sensor/Switch C Circuit Malfunction
P0226 Throttle/Petal Position Sensor/Switch C Circuit Range/Performance Problem
P0227 Throttle/Petal Position Sensor/Switch C Circuit Low Input
P0228 Throttle/Petal Position Sensor/Switch C Circuit High Input
P0229 Throttle/Petal Position Sensor/Switch C Circuit Intermittent
P0230 Fuel Pump Primary Circuit Malfunction
P0231 Fuel Pump Secondary Circuit Low
P0232 Fuel Pump Secondary Circuit High
P0233 Fuel Pump Secondary Circuit Intermittent
P0234 Engine Overboost Condition
P0235 Turbocharger Boost Sensor A Circuit Malfunction
P0236 Turbocharger Boost Sensor A Circuit Range/Performance
P0237 Turbocharger Boost Sensor A Circuit Low
P0238 Turbocharger Boost Sensor A Circuit High
P0239 Turbocharger Boost Sensor B Malfunction
P0240 Turbocharger Boost Sensor B Circuit Range/Performance
P0241 Turbocharger Boost Sensor B Circuit Low
P0242 Turbocharger Boost Sensor B Circuit High
P0243 Turbocharger Wastegate Solenoid A Malfunction
P0244 Turbocharger Wastegate Solenoid A Range/Performance
P0245 Turbocharger Wastegate Solenoid A Low
P0246 Turbocharger Wastegate Solenoid A High

P0247 Turbocharger Wastegate Solenoid B Malfunction
P0248 Turbocharger Wastegate Solenoid B Range/Performance
P0249 Turbocharger Wastegate Solenoid B Low
P0250 Turbocharger Wastegate Solenoid B High
P0251 Injection Pump Fuel Metering Control "A" Malfunction (Cam/Rotor/Injector)
P0252 Injection Pump Fuel Metering Control "A" Range/Performance (Cam/Rotor/Injector)
P0253 Injection Pump Fuel Metering Control "A" Low (Cam/Rotor/Injector)
P0254 Injection Pump Fuel Metering Control "A" High (Cam/Rotor/Injector)
P0255 Injection Pump Fuel Metering Control "A" Intermittent (Cam/Rotor/Injector)
P0256 Injection Pump Fuel Metering Control "B" Malfunction (Cam/Rotor/Injector)
P0257 Injection Pump Fuel Metering Control "B" Range/Performance (Cam/Rotor/Injector)
P0258 Injection Pump Fuel Metering Control "B" Low (Cam/Rotor/Injector)
P0259 Injection Pump Fuel Metering Control "B" High (Cam/Rotor/Injector)
P0260 Injection Pump Fuel Metering Control "B" Intermittent (Cam/Rotor/Injector)
P0261 Cylinder 1 Injector Circuit Low
P0262 Cylinder 1 Injector Circuit High
P0263 Cylinder 1 Contribution/Balance Fault
P0264 Cylinder 2 Injector Circuit Low
P0265 Cylinder 2 Injector Circuit High
P0266 Cylinder 2 Contribution/Balance Fault
P0267 Cylinder 3 Injector Circuit Low
P0268 Cylinder 3 Injector Circuit High
P0269 Cylinder 3 Contribution/Balance Fault
P0270 Cylinder 4 Injector Circuit Low
P0271 Cylinder 4 Injector Circuit High
P0272 Cylinder 4 Contribution/Balance Fault
P0273 Cylinder 5 Injector Circuit Low
P0274 Cylinder 5 Injector Circuit High
P0275 Cylinder 5 Contribution/Balance Fault
P0276 Cylinder 6 Injector Circuit Low
P0277 Cylinder 6 Injector Circuit High
P0278 Cylinder 6 Contribution/Balance Fault
P0279 Cylinder 7 Injector Circuit Low
P0280 Cylinder 7 Injector Circuit High
P0281 Cylinder 7 Contribution/Balance Fault
P0282 Cylinder 8 Injector Circuit Low
P0283 Cylinder 8 Injector Circuit High
P0284 Cylinder 8 Contribution/Balance Fault
P0285 Cylinder 9 Injector Circuit Low
P0286 Cylinder 9 Injector Circuit High
P0287 Cylinder 9 Contribution/Balance Fault
P0288 Cylinder 10 Injector Circuit Low
P0289 Cylinder 10 Injector Circuit High
P0290 Cylinder 10 Contribution/Balance Fault
P0291 Cylinder 11 Injector Circuit Low
P0292 Cylinder 11 Injector Circuit High
P0293 Cylinder 11 Contribution/Balance Fault
P0294 Cylinder 12 Injector Circuit Low
P0295 Cylinder 12 Injector Circuit High
P0296 Cylinder 12 Contribution/Range Fault
P0300 Random/Multiple Cylinder Misfire Detected
P0301 Cylinder 1 Misfire Detected
P0302 Cylinder 2 Misfire Detected
P0303 Cylinder 3 Misfire Detected
P0304 Cylinder 4 Misfire Detected
P0305 Cylinder 5 Misfire Detected
P0306 Cylinder 6 Misfire Detected
P0307 Cylinder 7 Misfire Detected
P0308 Cylinder 8 Misfire Detected
P0309 Cylinder 9 Misfire Detected
P0311 Cylinder 11 Misfire Detected
P0312 Cylinder 12 Misfire Detected
P0320 Ignition/Distributor Engine Speed Input Circuit Malfunction
P0321 Ignition/Distributor Engine Speed Input Circuit Range/Performance
P0322 Ignition/Distributor Engine Speed Input Circuit No Signal
P0323 Ignition/Distributor Engine Speed Input Circuit Intermittent
P0325 Knock Sensor 1 Circuit Malfunction (Bank 1 or Single Sensor)
P0326 Knock Sensor 1 Circuit Range/Performance (Bank 1 or Single Sensor)
P0327 Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)
P0328 Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)
P0329 Knock Sensor 1 Circuit Intermittent (Bank 1 or Single Sensor)
P0330 Knock Sensor 2 Circuit Malfunction (Bank 2)

P0331 Knock Sensor 2 Circuit Range/Performance (Bank 2)
P0332 Knock Sensor 2 Circuit Low Input (Bank 2)
P0333 Knock Sensor 2 Circuit High Input (Bank 2)
P0334 Knock Sensor 2 Circuit Intermittent (Bank 2)
P0335 Crankshaft Position Sensor A Circuit Malfunction
P0336 Crankshaft Position Sensor A Circuit Range/Performance
P0337 Crankshaft Position Sensor A Circuit Low Input
P0338 Crankshaft Position Sensor A Circuit High Input
P0339 Crankshaft Position Sensor A Circuit Intermittent
P0340 Camshaft Position Sensor Circuit Malfunction
P0341 Camshaft Position Sensor Circuit Range/Performance
P0342 Camshaft Position Sensor Circuit Low Input
P0343 Camshaft Position Sensor Circuit High Input
P0344 Camshaft Position Sensor Circuit Intermittent
P0350 Ignition Coil Primary/Secondary Circuit Malfunction
P0351 Ignition Coil A Primary/Secondary Circuit Malfunction
P0352 Ignition Coil B Primary/Secondary Circuit Malfunction
P0353 Ignition Coil C Primary/Secondary Circuit Malfunction
P0354 Ignition Coil D Primary/Secondary Circuit Malfunction
P0355 Ignition Coil E Primary/Secondary Circuit Malfunction
P0356 Ignition Coil F Primary/Secondary Circuit Malfunction
P0357 Ignition Coil G Primary/Secondary Circuit Malfunction
P0358 Ignition Coil H Primary/Secondary Circuit Malfunction
P0359 Ignition Coil I Primary/Secondary Circuit Malfunction
P0360 Ignition Coil J Primary/Secondary Circuit Malfunction
P0361 Ignition Coil K Primary/Secondary Circuit Malfunction
P0362 Ignition Coil L Primary/Secondary Circuit Malfunction
P0370 Timing Reference High Resolution Signal A Malfunction
P0371 Timing Reference High Resolution Signal A Too Many Pulses
P0372 Timing Reference High Resolution Signal A Too Few Pulses
P0373 Timing Reference High Resolution Signal A Intermittent/Erratic Pulses
P0374 Timing Reference High Resolution Signal A No Pulses
P0375 Timing Reference High Resolution Signal B Malfunction
P0376 Timing Reference High Resolution Signal B Too Many Pulses
P0377 Timing Reference High Resolution Signal B Too Few Pulses
P0378 Timing Reference High Resolution Signal B Intermittent/Erratic Pulses
P0379 Timing Reference High Resolution Signal B No Pulses
P0380 Glow Plug/Heater Circuit "A" Malfunction
P0381 Glow Plug/Heater Indicator Circuit Malfunction
P0382 Exhaust Gas Recirculation Flow Malfunction
P0385 Crankshaft Position Sensor B Circuit Malfunction
P0386 Crankshaft Position Sensor B Circuit Range/Performance
P0387 Crankshaft Position Sensor B Circuit Low Input
P0388 Crankshaft Position Sensor B Circuit High Input
P0389 Crankshaft Position Sensor B Circuit Intermittent
P0400 Exhaust Gas Recirculation Flow Malfunction
P0401 Exhaust Gas Recirculation Flow Insufficient Detected
P0402 Exhaust Gas Recirculation Flow Excessive Detected
P0403 Exhaust Gas Recirculation Circuit Malfunction
P0404 Exhaust Gas Recirculation Circuit Range/Performance
P0405 Exhaust Gas Recirculation Sensor A Circuit Low
P0406 Exhaust Gas Recirculation Sensor A Circuit High
P0407 Exhaust Gas Recirculation Sensor B Circuit Low
P0408 Exhaust Gas Recirculation Sensor B Circuit High
P0410 Secondary Air Injection System Malfunction
P0411 Secondary Air Injection System Incorrect Flow Detected
P0412 Secondary Air Injection System Switching Valve A Circuit Malfunction
P0413 Secondary Air Injection System Switching Valve A Circuit Open
P0414 Secondary Air Injection System Switching Valve A Circuit Shorted
P0415 Secondary Air Injection System Switching Valve B Circuit Malfunction
P0416 Secondary Air Injection System Switching Valve B Circuit Open
P0417 Secondary Air Injection System Switching Valve B Circuit Shorted
P0418 Secondary Air Injection System Relay "A" Circuit Malfunction
P0419 Secondary Air Injection System Relay "B" Circuit Malfunction
P0420 Catalyst System Efficiency Below Threshold (Bank 1)
P0421 Warm Up Catalyst Efficiency Below Threshold (Bank 1)
P0422 Main Catalyst Efficiency Below Threshold (Bank 1)
P0423 Heated Catalyst Efficiency Below Threshold (Bank 1)
P0424 Heated Catalyst Temperature Below Threshold (Bank 1)
P0430 Catalyst System Efficiency Below Threshold (Bank 2)
P0431 Warm Up Catalyst Efficiency Below Threshold (Bank 2)
P0432 Main Catalyst Efficiency Below Threshold (Bank 2)

P0433 Heated Catalyst Efficiency Below Threshold (Bank 2)
P0434 Heated Catalyst Temperature Below Threshold (Bank 2)
P0440 Evaporative Emission Control System Malfunction
P0441 Evaporative Emission Control System Incorrect Purge Flow
P0442 Evaporative Emission Control System Leak Detected (small leak)
P0443 Evaporative Emission Control System Purge Control Valve Circuit Malfunction
P0444 Evaporative Emission Control System Purge Control Valve Circuit Open
P0445 Evaporative Emission Control System Purge Control Valve Circuit Shorted
P0446 Evaporative Emission Control System Vent Control Circuit Malfunction
P0447 Evaporative Emission Control System Vent Control Circuit Open
P0448 Evaporative Emission Control System Vent Control Circuit Shorted
P0449 Evaporative Emission Control System Vent Valve/Solenoid Circuit Malfunction
P0450 Evaporative Emission Control System Pressure Sensor Malfunction
P0451 Evaporative Emission Control System Pressure Sensor Range/Performance
P0452 Evaporative Emission Control System Pressure Sensor Low Input
P0453 Evaporative Emission Control System Pressure Sensor High Input
P0454 Evaporative Emission Control System Pressure Sensor Intermittent
P0455 Evaporative Emission Control System Leak Detected (gross leak)
P0460 Fuel Level Sensor Circuit Malfunction
P0461 Fuel Level Sensor Circuit Range/Performance
P0462 Fuel Level Sensor Circuit Low Input
P0463 Fuel Level Sensor Circuit High Input
P0464 Fuel Level Sensor Circuit Intermittent
P0465 Purge Flow Sensor Circuit Malfunction
P0466 Purge Flow Sensor Circuit Range/Performance
P0467 Purge Flow Sensor Circuit Low Input
P0468 Purge Flow Sensor Circuit High Input
P0469 Purge Flow Sensor Circuit Intermittent
P0470 Exhaust Pressure Sensor Malfunction
P0471 Exhaust Pressure Sensor Range/Performance
P0472 Exhaust Pressure Sensor Low
P0473 Exhaust Pressure Sensor High
P0474 Exhaust Pressure Sensor Intermittent
P0475 Exhaust Pressure Control Valve Malfunction
P0476 Exhaust Pressure Control Valve Range/Performance
P0477 Exhaust Pressure Control Valve Low
P0478 Exhaust Pressure Control Valve High
P0479 Exhaust Pressure Control Valve Intermittent
P0480 Cooling Fan 1 Control Circuit Malfunction
P0481 Cooling Fan 2 Control Circuit Malfunction
P0482 Cooling Fan 3 Control Circuit Malfunction
P0483 Cooling Fan Rationality Check Malfunction
P0484 Cooling Fan Circuit Over Current
P0485 Cooling Fan Power/Ground Circuit Malfunction
P0500 Vehicle Speed Sensor Malfunction
P0501 Vehicle Speed Sensor Range/Performance
P0502 Vehicle Speed Sensor Low Input
P0503 Vehicle Speed Sensor Intermittent/Erratic/High
P0505 Idle Control System Malfunction
P0506 Idle Control System RPM Lower Than Expected
P0507 Idle Control System RPM Higher Than Expected
P0510 Closed Throttle Position Switch Malfunction
P0520 Engine Oil Pressure Sensor/Switch Circuit Malfunction
P0521 Engine Oil Pressure Sensor/Switch Circuit Range/Performance
P0522 Engine Oil Pressure Sensor/Switch Circuit Low Voltage
P0523 Engine Oil Pressure Sensor/Switch Circuit High Voltage
P0530 A/C Refrigerant Pressure Sensor Circuit Malfunction
P0531 A/C Refrigerant Pressure Sensor Circuit Range/Performance
P0532 A/C Refrigerant Pressure Sensor Circuit Low Input
P0533 A/C Refrigerant Pressure Sensor Circuit High Input
P0534 Air Conditioner Refrigerant Charge Loss
P0550 Power Steering Pressure Sensor Circuit Malfunction
P0551 Power Steering Pressure Sensor Circuit Range/Performance
P0552 Power Steering Pressure Sensor Circuit Low Input
P0553 Power Steering Pressure Sensor Circuit High Input
P0554 Power Steering Pressure Sensor Circuit Intermittent
P0560 System Voltage Malfunction
P0561 System Voltage Unstable
P0562 System Voltage Low
P0563 System Voltage High
P0565 Cruise Control On Signal Malfunction
P0566 Cruise Control Off Signal Malfunction

P0567 Cruise Control Resume Signal Malfunction
P0568 Cruise Control Set Signal Malfunction
P0569 Cruise Control Coast Signal Malfunction
P0570 Cruise Control Accel Signal Malfunction
P0571 Cruise Control/Brake Switch A Circuit Malfunction
P0572 Cruise Control/Brake Switch A Circuit Low
P0573 Cruise Control/Brake Switch A Circuit High
P0574 Cruise Control Related Malfunction
P0575 Cruise Control Related Malfunction
P0576 Cruise Control Related Malfunction
P0576 Cruise Control Related Malfunction
P0578 Cruise Control Related Malfunction
P0579 Cruise Control Related Malfunction
P0580 Cruise Control Related Malfunction
P0600 Serial Communication Link Malfunction
P0601 Internal Control Module Memory Check Sum Error
P0602 Control Module Programming Error
P0603 Internal Control Module Keep Alive Memory (KAM) Error
P0604 Internal Control Module Random Access Memory (RAM) Error
P0605 Internal Control Module Read Only Memory (ROM) Error
P0606 PCM Processor Fault
P0608 Control Module VSS Output "A" Malfunction
P0609 Control Module VSS Output "B" Malfunction
P0620 Generator Control Circuit Malfunction
P0621 Generator Lamp "L" Control Circuit Malfunction
P0622 Generator Field "F" Control Circuit Malfunction
P0650 Malfunction Indicator Lamp (MIL) Control Circuit Malfunction
P0654 Engine RPM Output Circuit Malfunction
P0655 Engine Hot Lamp Output Control Circuit Malfucntion
P0656 Fuel Level Output Circuit Malfunction
P0700 Transmission Control System Malfunction
P0701 Transmission Control System Range/Performance
P0702 Transmission Control System Electrical
P0703 Torque Converter/Brake Switch B Circuit Malfunction
P0704 Clutch Switch Input Circuit Malfunction
P0705 Transmission Range Sensor Circuit malfunction (PRNDL Input)
P0706 Transmission Range Sensor Circuit Range/Performance
P0707 Transmission Range Sensor Circuit Low Input
P0708 Transmission Range Sensor Circuit High Input
P0709 Transmission Range Sensor Circuit Intermittent
P0710 Transmission Fluid Temperature Sensor Circuit Malfunction
P0711 Transmission Fluid Temperature Sensor Circuit Range/Performance
P0712 Transmission Fluid Temperature Sensor Circuit Low Input
P0713 Transmission Fluid Temperature Sensor Circuit High Input
P0714 Transmission Fluid Temperature Sensor Circuit Intermittent
P0715 Input/Turbine Speed Sensor Circuit Malfunction
P0716 Input/Turbine Speed Sensor Circuit Range/Performance
P0717 Input/Turbine Speed Sensor Circuit No Signal
P0718 Input/Turbine Speed Sensor Circuit Intermittent
P0719 Torque Converter/Brake Switch B Circuit Low
P0720 Output Speed Sensor Circuit Malfunction
P0721 Output Speed Sensor Range/Performance
P0722 Output Speed Sensor No Signal
P0723 Output Speed Sensor Intermittent
P0724 Torque Converter/Brake Switch B Circuit High
P0725 Engine Speed input Circuit Malfunction
P0726 Engine Speed Input Circuit Range/Performance
P0727 Engine Speed Input Circuit No Signal
P0728 Engine Speed Input Circuit Intermittent
P0730 Incorrect Gear Ratio
P0731 Gear 1 Incorrect ratio
P0732 Gear 2 Incorrect ratio
P0733 Gear 3 Incorrect ratio
P0734 Gear 4 Incorrect ratio
P0735 Gear 5 Incorrect ratio
P0736 Reverse incorrect gear ratio
P0740 Torque Converter Clutch Circuit Malfuction
P0741 Torque Converter Clutch Circuit Performance or Stuck Off
P0742 Torque Converter Clutch Circuit Stuck On
P0743 Torque Converter Clutch Circuit Electrical
P0744 Torque Converter Clutch Circuit Intermittent
P0745 Pressure Control Solenoid Malfunction

P0746 Pressure Control Solenoid Performance or Stuck Off
P0747 Pressure Control Solenoid Stuck On
P0748 Pressure Control Solenoid Electrical
P0749 Pressure Control Solenoid Intermittent
P0750 Shift Solenoid A Malfunction
P0751 Shift Solenoid A Performance or Stuck Off
P0752 Shift Solenoid A Stuck On
P0753 Shift Solenoid A Electrical
P0754 Shift Solenoid A Intermittent
P0755 Shift Solenoid B Malfunction
P0756 Shift Solenoid B Performance or Stuck Off
P0757 Shift Solenoid B Stuck On
P0758 Shift Solenoid B Electrical
P0759 Shift Solenoid B Intermittent
P0760 Shift Solenoid C Malfunction
P0761 Shift Solenoid C Performance or Stuck Off
P0762 Shift Solenoid C Stuck On
P0763 Shift Solenoid C Electrical
P0764 Shift Solenoid C Intermittent
P0765 Shift Solenoid D Malfunction
P0766 Shift Solenoid D Performance or Stuck Off
P0767 Shift Solenoid D Stuck On
P0768 Shift Solenoid D Electrical
P0769 Shift Solenoid D Intermittent
P0770 Shift Solenoid E Malfunction
P0771 Shift Solenoid E Performance or Stuck Off
P0772 Shift Solenoid E Stuck On
P0773 Shift Solenoid E Electrical
P0774 Shift Solenoid E Intermittent
P0780 Shift Malfunction
P0781 1-2 Shift Malfunction
P0782 2-3 Shift Malfunction
P0783 3-4 Shift Malfunction
P0784 4-5 Shift Malfunction
P0785 Shift/Timing Solenoid Malfunction
P0786 Shift/Timing Solenoid Range/Performance
P0787 Shift/Timing Solenoid Low
P0788 Shift/Timing Solenoid High
P0789 Shift/Timing Solenoid Intermittent
P0790 Normal/Performance Switch Circuit Malfunction
P0801 Reverse Inhibit Control Circuit Malfunction
P0803 1-4 Upshift (Skip Shift) Solenoid Control Circuit Malfunction
P0804 1-4 Upshift (Skip Shift) Lamp Control Circuit Malfunction

Attachment 9 – DOTD Expenditure Impact

	Expenditure Increase (Decrease)				
DOTD COSTS	2003-04	2004-05	2005-06	2006-07	2007-08
1.Software/Support	170,000	170,000	170,000	170,000	170,000
2.Equipment	199,500	500,000	500,000	50,000	50,000
3.Prof. Service	75,000	0	0	0	0
4.Operating Expense	-	(260,000)	(520,000)	(520,000)	(520,000)
Total	**444,500**	**410,000**	**150,000**	**(300,000)**	**(300,000)**

10-Year Return on Investment = 33% per annum (see Note below)
10-Year Investment Cost as Percentage of Existing DOTD Vehicle and Equipment Assets = .006%

Explanation of DOTD Expenditure Impact

The net expenditure increase between FY2003-08 is $304,500. It is proposed that $444,500 of 2003-04 expenditures be covered by the Technology Innovation Fund for initial implementation. Assuming successful implementation and performance indicators, DOTD will fund ongoing system use and telematics hardware installation for all DOTD vehicle and equipment assets FY2004-2008. Following are expenditure increase/decrease details:

1. Software/Support – $170,000 represents annual cost for software licensing (subscription) inclusive of ongoing support, maintenance, and upgrades.
2. Equipment:
   a. 2003-04: $199,500 to outfit 50 DOTD vehicle and equipment assets at each district site with the telematics hardware (in-vehicle hardware);
   b. 2004-05: $500,000 to outfit an additional 2,750 DOTD vehicle and equipment assets across all DOTD sites;
   c. 2005-06: $500,000 to outfit all remaining 2,750 DOTD vehicle and equipment assets across all DOTD sites;
   d. 2006-07: $50,000 to outfit newly acquired DOTD vehicle and equipment assets across all DOTD sites;
   e. 2007-08: $50,000 to outfit newly acquired DOTD vehicle and equipment assets across all DOTD sites.
3. Professional Service - $75,000 for initial vendor service to implement software, hardware and provide training.
4. Operating Expense:
   a. 2003-04: $0 net change in operating expenses during system rollout/implementation;
   b. 2004-05: $260,000 decrease in operating expense representing 50% of the savings specified in items 1, 2, and 5 in Section VI Cost/Benefit Analysis. Realize only 50% item 1, 2, and 5 savings because system is implemented for approximately 50% DOTD vehicle and equipment assets at this time;
   c. 2005-06: $520,000 decrease in operating expense representing savings specified in items 1, 2, and 5 in Section VI Cost/Benefit Analysis;
   d. 2006-07: $520,000 decrease in operating expense representing savings specified in items 1, 2, and 5 in Section VI Cost/Benefit Analysis;
   e. 2007-08: $520,000 decrease in operating expense representing savings specified in items 1, 2, and 5 in Section VI Cost/Benefit Analysis.

NOTE: Decreased operating expenses and calculated return on investment above do not take into consideration items 3, 4, and 6 in Section VI Cost/Benefit Analysis because DOTD considered these savings less quantifiable given no historical references or benchmarks or, in the case of item F, given that these savings were not DOTD specific. However, these benefits actually represent potential savings that could far outweigh those presented above.